Docket No. 6215.36004

SPECIFICATION

TO ALL WHOM IT MAY CONCERN

BE IT KNOWN that I, William M. Scott, currently residing in Fort Worth, Texas, have invented new and useful improvements in a

PULL STRIP FOR FORMING HOLES

of which the following is a specification:

PULL STRIP FOR FORMING HOLES

SPECIFICATION

This application is a continuation-in-part of U.S. Patent Application No. 10/094,286, filed March 8, 2002.

Background of the Invention

Field of the Invention

The invention relates to a device and method for forming holes in new structures such as concrete.

Description of the Prior Art

In many construction projects formed of concrete, holes must be drilled into the concrete for receiving rebar for allowing the attachment of other structures to the concrete. The drilling procedure requires expensive drilling equipment and is time consuming. In other procedures, metal or plastic sleeves are placed in the concrete when wet for forming holes for receiving rebar rods. The sleeves cannot be removed and remain in the concrete when it dries.

Summary of the Invention

It is an object of the invention for providing a new and useful device for use for forming holes in new concrete structures without any drilling required.

It is a further object of the invention to provide a new and process for forming holes in new concrete structures without any drilling required.

The present invention provides a device for use for forming an aperture in structure formed from unsolidified material that is capable of solidifying to a hard state The device comprises a strand of flexible material that is helically coiled in the form of a preformed elongated tubular member having adjacent coils extending between opposite ends of said preformed member removably bonded together and having a given outside diameter such that said preformed member may be embedded in unsolidified material with one of said ends extending at least close to a surface of said material such that when said material solidifies, said one end of said strand may be pulled to break the bonds between adjacent coils of said strand to remove said strand from said solidified material to form an aperture in said solidified material from the surface.

In accordance with one aspect of the present invention, the strand is formed of flexible plastic material helically coiled to form said preformed member.

In accordance with still another aspect of the present invention, the preformed member has an aperture extending from said one end through the other of said ends with a cap coupled to said one end of said strand partially covering said aperture at said one end.

In accordance with still another aspect of the present invention, the strand is formed of flexible plastic material helically coiled to form said preformed member.

In accordance with still another aspect of the present invention, there is gripping means coupled to said cap to facilitate removal of said preformed member from said solidified material.

In accordance with still another aspect of the present invention, the strand is helically coiled to form said preformed member with an aperture extending from said one end to the other of said ends with said aperture at said other end being closed.

The present invention also provides a tubular member formed from a plastic material and having two opposite ends with a tubular sidewall comprising an inner surface defining a central aperture extending between said opposite ends and an outer surface comprising a helical coil extending between said opposite ends defining a plurality of adjacent coils with said sidewall between adjacent coils at said inner surface being thin enough to be broken by pulling on one end of said tubular member while at least a portion of said tubular member spaced from said one end is held stationary to pull adjacent coils apart such that said tubular member may be embedded in unsolidified material with said one end extending at least close to a surface of said material such that when said material solidifies, said one end of said member may be pulled to break said side wall at said inner surface between adjacent coils to pull said member from said solidified material to form an aperture in said solid material from the surface.

In accordance with one aspect of the present invention, the sidewall between adjacent coils at said inner surface has radial dimensions much less that the radial dimensions of said coils from said inner surface.

The present invention also provides a structure, having a concrete material having at least one surface, and an elongated helical tubular member having adjacent coils that contact one another, the member having two opposite ends. The member is located in the concrete material such that one of the ends is located close to the surface.

In accordance with one aspect of the present invention, there is a support in contact with the member, the support extending to a side of the concrete material.

In accordance with still another aspect of the present invention, the support further comprises one or more wires couple to an outside of the member.

In accordance with still another aspect of the present invention, the support further comprises a mandrel inserted into the member and coupled to a wall along the surface of the concrete material.

In accordance with still another aspect of the present invention, there is a plate for coupling the mandrel to the wall.

The present invention also provides a method of forming an aperture into structure formed from unsolidified material that is capable of solidifying to a hard state. An elongated preformed tubular member having two opposite ends is embedded in said unsolidified material with one of said ends located close to a surface of said material. The preformed member

comprises a strand of flexible material that is helically coiled, with the coils being in contact with adjacent coils and having a given outside diameter. After said material solidifies, pulling said one end of said strand to separate adjacent coils of said strand to remove said strand from said solidified material to form an aperture in said solidified material from said surface.

In accordance with one aspect of the present invention, the preformed member is embedded in said material when in an unsolidified state by pushing the other of said ends of said preformed member into said unsolidified material until said one end of said preformed member is located close to said surface of said material.

In accordance with still another aspect of the present invention, the preformed member is embedded in said material when in an unsolidified state by attaching said preformed member to a support member, and the unsolidified material is placed around said preformed member with said one end located close to said surface of said material.

In accordance with still another aspect of the present invention, the said material of said structure comprises concrete.

In accordance with still another aspect of the present invention, the solidified material forms a first slab of solidified material. A metal rod is inserted and secured into said aperture with an outer end of said rod extending out of said solidified material The outer end of said rod is embedded with unsolidified material which solidifies to form a second slab of solidified material with said first and second slabs of solidified material being joined by said embedded rod.

The present invention also provides a method of providing an anchor in a concrete material. A tubular member is provided, which comprises a strand of flexible material with two opposite ends. The material is helically coiled, with each coil being in contact with adjacent coils. The tubular member having an outside thread pattern. The tubular member is embedded in the unsolidified concrete material with one of the ends located close to a surface of the material. After the concrete material solidifies, the one end is pulled to separate adjacent coils and remove the strand from the concrete material, leaving an aperture in the concrete material from the surface. The aperture has the thread pattern. An anchor member having the same thread pattern is inserted into the aperture.

In accordance with one aspect of the present invention, the concrete material is lifted by way of the anchor member.

In accordance with another aspect of the present invention, a worker safety system is secured to the anchor member.

Brief Description of the Drawings

Fig. 1 is a side view of the coiled pull strip or strand of the invention with adjacent coils bonded together.

Fig. 2 is a cross-section of the coiled stand of Fig. 1.

Fig. 3 is a top end view of the coiled strand of Figs. 1 and 2.

Fig. 4 is a bottom end view of the coiled strand of Figs. 1 and 2.

Fig. 5 is a modification of the coiled strand of Figs. 1-4.

Fig. 6 illustrates the coiled strand of Figs. 1 and 2 lengthened by pulling the strand in one direction breaking the bonds between adjacent coils.

Fig. 7 illustrates two of the coiled strands of Fig. 1 connected to reinforcing wire or rods in a trough for receiving concrete.

Fig. 8 is a top plan view of one of the coiled strands of Fig. 7 held in place.

Fig. 9 illustrates a coiled strand on the left embedded in solidified concrete poured to form a desired structure and a hole formed on the right of the poured concrete after the strand has been pulled out of the concrete.

Fig. 10 illustrates a coiled strand of the invention being pulled from a solidified concrete structure to form a hole therein.

Figs. 11 and 12 illustrate the modified coiled strand of Fig. 5 being pushed into wet concrete to locate it in the position as shown in Fig. 12.

Figs. 13 and 14 illustrate the use of a mandrel to hold a coiled pull strip similar to that of Figs. 1 and 2 for use in forming a hole in the edge of a concrete slab.

Fig. 15 is a cross-section of the coiled pull strip of Figs. 13 and 14.

Fig. 16 illustrates the pull strip of Figs. 13-15 being pulled from the resulting hole formed in the dried concrete. In Fig. 16, the threads at the outer end are not shown for purposes of clarity.

In Fig. 17, the resulting hole formed in the dried concrete with the threads is shown in cross-section.

Fig. 18 illustrates a plurality of mandrels of the type of Fig. 13 secured to a frame for holding plastic pull strip sleeves of the type shown in Fig. 13.

Fig. 19 illustrates the pull strip sleeves located around the mandrels.

Fig. 20 illustrates the resulting threaded holes formed in a poured concrete slab after the mandrels and sleeves are removed and threaded rods to be screwed into the threaded holes.

Fig. 21 illustrates the ends of the rods extending out of the concrete edge.

Fig. 22 illustrates an adjacent slab poured next to the slab of Fig. 20 held together by the rods of Fig. 20.

Fig. 23 illustrates a rebar rod inserted into a threaded hole formed in concrete with the pull strip sleeve of Figs. 13-15 and held in place with a suitable plastic material.

Fig. 24 illustrates a modified coiled pull strip sleeve for use for forming a hole through a concrete floor.

The resulting hole in the concrete floor is shown in Fig. 25.

Fig. 26 is a cross-section of the sleeve of Fig. 24 located in a concrete floor around a metal sleeve.

Fig. 27 is a top view of the sleeve of Figs. 24 and 26.

Fig. 28 is a cross-section of the sleeve of Fig. 24.

Fig. 29 is a cross-section of a portion of a tubular pull strip device of the invention with which when used in combination of the Table 1 provides dimensions of different devices.

Fig. 30 is a cross-sectional view of a hole made with the device, shown in combination with a bolt.

Fig. 31 is a schematic view showing a worker safety line arrangement using the bolts and apertures.

Description of the Preferred Embodiments

Referring now to Figs. 1-4 and 6-10 of the drawings, the device of one embodiment of the invention is identified at 21. It comprises a tubular side wall 22 having a cylindrical inner surface 22A defining a central aperture 31 and an outer surface 22B comprising strand or strip of plastic material 23 helically coiled to form the elongated member 21 having a given length and a given outside diameter when its coils are bonded together. In this state, adjacent coils 23C of all of the coils are weakly or removably bonded together by a thin layer of plastic material 25. The top 27 of the member 25 has a cap 29 bonded to the top coil 23CT with a small circular opening 29A formed therethrough. From the cap to the bottom coil 23CB, the central aperture 31 extends from the cap 29 through the bottom coil 23CB. Gripping strips 33S and 33B extend outward from the cap 29.

By holding the device 21 at its lower end and pulling on the gripping strips 33A and 33B, the bonds 25 are broken such that adjacent coils 23C are pulled apart to lengthen the device 21 and reduce its outside diameter as shown at in Figs. 5 and 10. In Fig. 10 the resulting internal threads of the aperture 61 on the right side are not shown for purposes of clarity.

Referring to Figs. 7-9 the device of Figs. 1 and 2 is used in one embodiment in the following manner. In Figs. 7 and 8, members 41 and 43

are reinforcing metal wires or members secured in a zone defined by walls 45 to support concrete 51 poured in the zone to form a desired structure such as a roadway for supporting or guiding the wheels of passenger carrying vehicles. A plurality of the devices 21 are located in ring shaped metal members 53 and held in place by wires 55 and 57 (attached to the walls 45) in positions where the holes are desired in the concrete structure to be poured. The concrete 51 in a wet state is poured from device 59 in the zone surrounding the devices 21 with their top caps 29 located near or at the surface 51S of the concrete with their gripping strips 33A and 33B extending upward above the upper surface 51S of the concrete. The walls of the devices 21 keep the wet concrete out of the center apertures 31 of the devices. After the concrete 51 has cured or dried and solidified, the devices 21 are pulled out of the concrete leaving apertures in the concrete, one of which is shown at 61. The devices 21 can be pulled out of the solidified concrete by manually pulling upward on the strips 33A and 33B. As shown in Fig. 9. This causes the thin bonds 25 to break such that adjacent coils 23C are pulled apart lengthening the device 21 and reducing its outside diameter allowing it to be readily pulled out of the solidified concrete leaving the hole 61. Metal rebars 81 may be bonded into the holes 61 with a suitable plastic such that concrete tracks may be poured on the upper surface 55S of the concrete and held in place by the rebars.

Although the invention is employed to form holes in new concrete, it is to be understood that it could be used to form holes in other type of materials that solidifies from an uncured state to a cured state.

Referring to Figs. 5 and 11 and 12, the device of Figs. 1 and 2 is modified to form the device 21A which is the same as device 21 except a plug 71 is inserted and attached in the lower end of the aperture 31 to plug the aperture 31 at the lower end 21L at coil 23CB. The device 21A is embedded into wet concrete 51 by pushing the lower end 21L of the device 21A into the wet concrete 51 until its cap 29 is located at the surface 51S of the wet concrete 51 as shown in Figs. 11 and 12. When the concrete 51 has solidified and hardened, the device 21A is pulled out of the concrete 51 in the same manner as device 21 is pulled out of the concrete as described in connection with Figs. 1-4 and 6-10 to form a hole 61 in the concrete.

In one embodiment, the plug 71 may be a suitable plastic or elastomer that is bonded inside of the aperture 31 at the lower end 21L of the device 21A.

Referring now to Figs. 13-22, there will be disclosed a device 121 similar to that of Figs. 1 and 2 for forming holes in concrete road slabs when formed for connection with an adjacent slab to be formed. The device 121 is formed without a cap as shown at 121 in Figs. 18-21. Thus, the device 121 is the similar to the device 21 of Figs. 1 and 2 except it has no cap 29 or gripping strips 33A and 33B. The device 121 may be injection molded from polyethylene or polypropylene. It comprises a helical strip strand forming adjacent coils 123C weakly bonded together by thin layers 125 of plastic material.

Referring to Figs. 13-18 wooden forms 131, 133, 135 are secured on a base 137 to form a cavity 149 into which wet concrete is to be poured. The

form 131 has a plurality of metal guides 151 secured thereto. Each guide 151 comprises a square base plate 153 with apertures 155 formed thereto to allow it to be attached to the form 131 with screws 157. Extending inward from the plate 153 is a cylindrical mandrel or rod 159. The devices 121 then are placed around each mandrel 159 and wet concrete 161 is poured into the cavity 149 around the devices 121. After the concrete has dried, the form 131 and the guides 151 are removed. Also removed are the forms 133 and 135. The devices 121 are pulled outward by breaking the bonds between adjacent coils leaving apertures 171 in the solidified concrete with internal threads 171T with the apertures extending inward from the edge 161E of the solidified concrete 161. One such aperture is shown at 171 in Fig. 17. Metal rods 181 with threads 181T then are screwed into each aperture 171 with an extending portion 181A extending out of the concrete edge 161E such that the next slab of concrete 191 can be poured next to edge 161E embedding the rod extensions 181A with the rods 181 securing adjacent edges of the concrete roadway together. Instead of using metal rods 181 with threads, metal rebar rods 185 may be dipped into a soft plastic material 83 and inserted into the apertures 171 as shown in Fig. 23. The plastic 83 when solidified will hold the rebar in place with their ends 185A employed for coupling with the next concrete slab to be poured. In Fig. 23, the threads of the apertures 171 are not shown on the right for purposes of clarity.

Referring now to Figs. 24-28 there is disclosed a concrete floor 201 in a building having an aperture 203 formed there through for receiving utility pipes, etc. The aperture is formed by using another embodiment of the

invention. Fig. 25 does not show the details of the aperture such as the internal threads etc. The embodiment comprises a cup shaped plastic member 221 injection molded to form and having a cylindrical shaped wall 231 formed of helical coils 233 with adjacent coils being removably bonded together with a thin layer of plastic material 235. The member 221 has a top wall 237 to which four pull strips 239 are attached. The member 221 has a central opening 241 which is open at its lower end.

The member 221 is used to form the aperture 203 through the floor 201. An annular thin metal setting sleeve 251 with a lower metal wall or pan 253 also is employed in forming the aperture 203.

In forming the concrete floor 201, suitable forms are provided for receiving wet concrete. Member 255 is a deck onto which the concrete is poured. In forming the aperture 203, the metal sleeve 251 and wall 253 are placed where the aperture is desired and the member 221 is located around the sleeve 251 as shown in Fig. 26. The sleeve 251 is provided to give support to the member 221. After the concrete is poured and has solidified, the pull strip coil 233 then is pulled to cause the coils 233 to be pulled apart tearing or breaking the thin layers 235 to allow the coils to be pulled outward reducing the outer diameters of the coils strand 233 such that the coil strip 233 may be removed from between the sleeve 251 and the aperture 203 formed by the coil member 221. When the deck wall 255 is removed, the sleeve 251 and wall 253 will be removed leaving the floor 201 with the aperture 203 formed therethrough.

In one embodiment the device 21, 121 or member 221 (device) may be injection molded from polyethylene or polypropylene. As an example, the device or member has a length of 5-12 inches and an outside diameter of 3/8-12 inches in an unstretched state. Referring to Fig. 29, the device or member has a maximum wall thickness A and a minimum wall thickness B. The minimum wall thickness B is the bonding layer or joint between the coils. The wall thickness B is much less than the wall thickness A so that when the coils (wall thickness A) are pulled, the joint (wall thickness B) will separate, while leaving the coils in one integral length. By way of example only, the maximum wall thickness can be 1/8 inches while the minimum wall thickness is 1/16 inches. By way of example only, for large size coils, 2-12 inches in diameter, the maximum wall thickness can be 3/16 inches, while the minimum wall thickness can be 1/8 inches. As still another example, the maximum wall thickness is about 1.25 millimeters (mm) while the minimum wall thickness is about 0.125 mm. The wall thicknesses, diameters and lengths of the devices can vary according to the particular application.

In another embodiment, the device is a coiled spring, where the coils are not joined together. The device can be made of metal or plastic. The coils are relatively stiff and tightly wound, wherein each individual coil contacts the adjacent coils, so as to prevent intrusion by the wet concrete between the coils. Once the concrete is set, an end of the device is pulled, separating the coils from one another and allowing removal of the device from the hole.

Fig. 30 shows an aperture 171 formed in concrete, after the device 121 has been removed. Fig. 30 is substantially the same as that shown in Fig. 17. Instead of metal rods 181 of Fig. 20, bolts 301 are inserted into the apertures 171. The bolts 301 have threads 303 that match the threads 171T in the aperture 171. The head 305 of the bolt can be a variety of shapes and sizes, such as hex head, allen, eye, etc.

Once the bolt 301 is screwed into the aperture 171, the bolt forms an anchor that is firmly secured to the concrete. A portion of the bolt (the head and part of the shank) is left exposed.

The bolt and aperture arrangement can be used in a number of applications. For example, a dead man, or block of concrete, can be fitted with bolts received by apertures so as to provide lifting points to move the blocks. As another example, the bolts can provide anchor points for worker safety lines (see Fig. 31). In the construction of concrete buildings, apertures 171 can be made in concrete columns 311 and bolts 301 set. Safety lines 313 can then be extended from column to column, secured to the bolts. Workers can tie their tether lines 315 to the safety lines. Such a system greatly improves worker safety, particularly on high rise buildings.

The foregoing disclosure and showings made in the drawings are merely illustrative of the principles of this invention and are not to be interpreted in a limiting sense.